PLAINTIFF'S REPLY EXHIBIT 3

IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF WEST VIRGINIA
AT CHARLESTON

WEST VIRGINIA RIVERS COALITION, INC.,
Plaintiff,

v. **Civil Action No. 2:24-cv-00701**

THE CHEMOURS COMPANY FC, LLC,
Defendant.

DECLARATION OF DR. BETH HOAGLAND

I, Beth Hoagland, Ph.D., do hereby certify, swear or affirm, that the following statements are true and correct to the best of my knowledge:

1. I am a resident of Highland, Maryland.

2. I am over eighteen years old and of sound mind.

3. I make this Declaration in conjunction with the Plaintiff's Reply in Support of its Motion for a Preliminary Injunction.

4. I am a Geochemist at S.S. Papadopulos & Associates, Inc. (SSPA) with more than seven years of experience in evaluating the fate and transport of contaminants in surface water and groundwater.

5. I have a B.A. in Environmental Earth Sciences from Washington University, St. Louis; a Ph.D. in Geosciences and Biogeochemistry from The Pennsylvania State University; and I completed a post-doctoral research fellowship at the Colorado School of Mines.

6. My areas of expertise include contaminant fate and transport, groundwater/surface water interactions, and geochemical modeling.

7. My work in geochemistry includes evaluation of the sources, transformation, and transport of contaminants (e.g. PFAS), geochemical fingerprinting, geochemical assessments of managed aquifer recharge, and field investigations and sampling.

8. My curriculum vitae, a copy of which is attached, describes my recent projects, publications, professional training, and public presentations.

9. I have reviewed the following documents and data in connection with this matter:

a. The Defendant's Response in Opposition to the Plaintiff's Motion for a Preliminary Injunction, dated March 11, 2025, including the following Exhibits,

   i. The Declaration of Andrew Hartten in Support of Chemours' Response in Opposition to Plaintiff's Motion for a Preliminary Injunction ("Hartten Decl.").

   ii. The Declaration of Catherine Boston in Support of Chemours' Response in Opposition to Plaintiff's Motion for a Preliminary Injunction ("Boston Decl.").

b. The Plaintiff's Motion for a Preliminary Injunction, dated February 25, 2025.

c. Ambient PFAS Levels in the Ohio River – Data and Report by the Ohio River Valley Water Sanitation Commission (ORSANCO), dated June 17, 2022 ("ORSANCO Report").

d. U.S. Geological Survey (USGS) Streamflow data for the following gaging stations:

   i. Site 03294500 Ohio River at Louisville, KY

   ii. Site 03114306 Ohio River above Sardis, OH

   iii. Site 03216600 Ohio River at Greenup Dam near Greenup, KY

e. Discharge Monitoring Report (DMR) data for Permit #WV0001279 for the period January 2021 through January 2025.

f. HFPO-DA River Sampling Results and the Ohio River Instream Sampling Plan and Data Summary, Attachment 19 to the 2023 Reissuance Application for Permit #WV0001279, dated February 21, 2023. [ECF No. 7-26]

g. Administrative Order on Consent, EPA Docket No. CWA-03-2023-0025DN, dated April 26, 2023. [ECF No. 7-18]

h. Attachment 25b to the 2024 Reissuance Application for Permit #WV0001279, Mass Loading Approach and Summary, dated December 17, 2024. [ECF No. 7-13]

i. Site Associated PFAS Fate and Transport Study, Chemours Fayetteville Works, Geosyntec Consultants, dated June 2019. [ECF No. 7-25]

j. Annex XV Report: Proposal for identification of a substance of very high concern on the basis of the criteria set out in REACH Article 57. The Netherlands, dated March 2019.

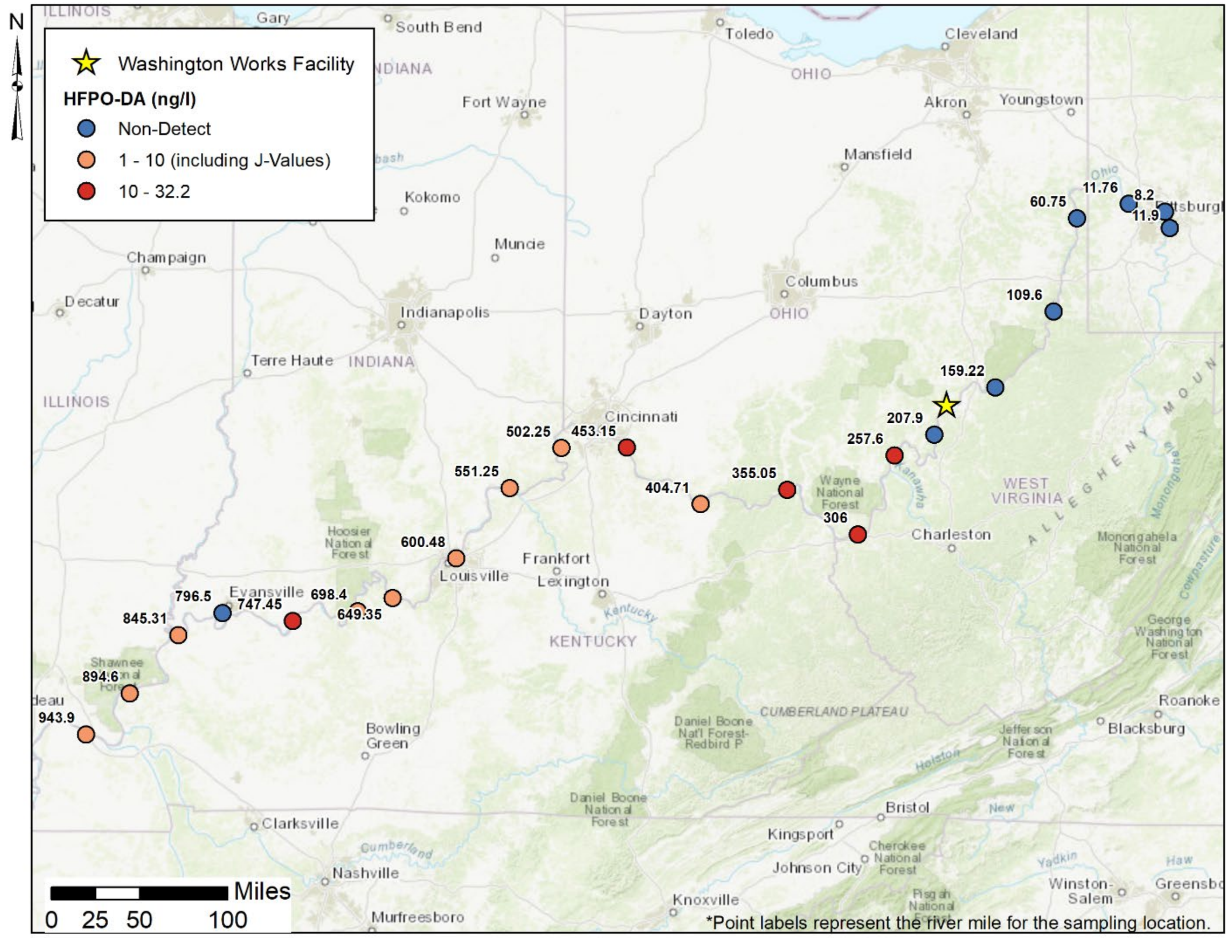
k. Declaration of Peter Goodmann in Support of Plaintiff's Motion for a Preliminary Injunction, dated February 20, 2025. [ECF No. 7-12]

10. ORSANCO led a sampling campaign in 2021 to develop an understanding of baseline conditions of PFAS in the Ohio River, as referenced in Mr. Hartten's Declaration (paragraphs 19-22). Two rounds of sampling were conducted, and samples were collected from 20 equidistant sites from river mile (RM) 11.8 to 943.9 spanning the full length of the Ohio River, as well as two tributary sites. Samples collected for the ORSANCO study relied upon an Equal Discharge Increment (EDI) sampling method. River flow was measured at each sampling location with an Acoustic Doppler Current Profiler (ADCP).

11. The Chemours Washington Works Facility in Parkersburg, WV, is located along RMs 189 to 191; Cincinnati, OH, is located at approximately RM 475; and Louisville, KY, is located at approximately RM 610, along the Ohio River. The ORSANCO Report sampling location at RM 207.9 represents the closest sampling location to the Washington Works facility as part of this study.

12. The first round of sampling by ORSANCO occurred over the course of approximately four weeks between June 15 and July 21, 2021, and measured Ohio River flows at the sampling locations ranged from 5,970 cubic feet per second (cfs) to 270,610 cfs. During this sampling campaign, all samples collected upstream of the Washington Works facility, from RM 11.8 to RM 159.2, had non-detectable levels of hexafluoropropylene oxide dimer acid (HFPO-DA; a chemical component of "GenX"). Downstream of the Washington Works facility (RM 207.9 to RM 943.9), HFPO-DA was detected in samples collected at 14 of 16 sampling locations

(including 6 values reported with a J-flag qualifier, which represent concentrations measured above the method detection limit but below the reporting limit). *See* map below.



HFPO-DA Concentrations in the Ohio River
June/July ORSANCO Sampling Event

13. The second round of sampling occurred over the course of approximately four weeks between September 29 and October 26, 2021, and measured Ohio River flows at the sampling locations ranged from 11,590 cfs to 251,240 cfs. During this sampling campaign, all locations upstream of the Washington Works facility, from RM 11.8 to RM 159.2, were non-

detect for HFPO-DA. Downstream of the Washington Works facility, from RM 207.9 to RM 943.9, HFPO-DA was detected in samples collected at 13 of 16 sampling locations (including 9 values reported with a J-flag qualifier).

14. Chemours has also monitored HFPO-DA concentrations in the Ohio River at an instream monitoring location 1.75 miles downstream of the Washington Works facility and 0.5 miles upstream of the City of Lubeck well field, as referenced in Ms. Boston's Declaration (paragraphs 21-22).

15. I offer the following opinions in this matter, based upon my education, training, and experience in the fields of geochemistry, as well as my review of the documents and datasets listed above.

16. Outlet discharges at the Chemours Washington Works facility in Parkersburg, WV, are a source of HFPO-DA to the Ohio River. Most of the facility discharges of HFPO-DA are from Outlets 002 and 005, which contribute 137 pounds per year (lbs/yr) of HFPO-DA to the Ohio River, compared to a total of 150 lbs/year for all outlets (according to Chemours' analysis in Attachment 25b to the 2024 Reissuance Application for Permit #WV0001279).

17. The monthly average concentrations of HFPO-DA discharged from Outlet 005, as reported in DMRs for WVDEP Permit #WV0001279, have been higher in recent months compared to monthly average concentrations reported for the period October 2021 to June 2024.

18. Mr. Hartten, in his declaration, correctly notes that ORSANCO study samples collected "at river mile 207.9 showed that HFPO-DA was not detected or was below the limit of detection in both events in 2021." (para 21). Mr. Hartten proceeds to note that "However, in July 2021, the five locations further downstream between river mile 257.6 and 543.2, ORSANCO

results showed HFPO-DA detected between 6 and 32.2 ng/L with the maximum detection at river mile 306.0." (para 22).

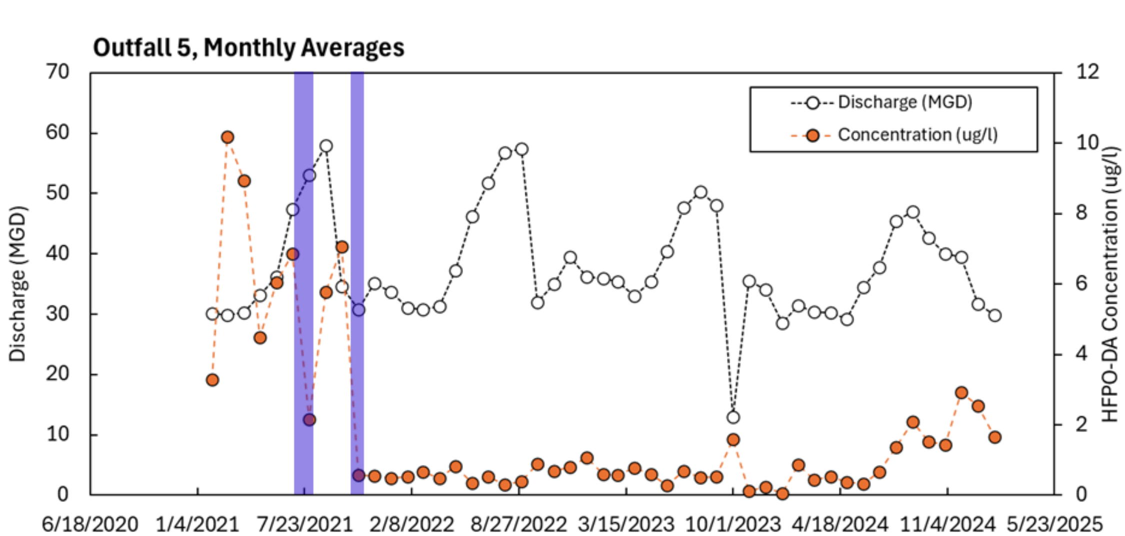
19. HFPO-DA concentrations in the Ohio River are a function of both the concentrations of HFPO-DA from sources discharging to the Ohio River, as well as the streamflow of the Ohio River at the time of sampling. In the June/July 2021 ORSANCO sampling event, the RM 207 sample that was non-detect for HFPO-DA was collected on July 12, which was 5 days after the collection of the RM 257.6 sample that had a detection of HFPO-DA (e.g. collected on July 7). The streamflow of the Ohio River as measured by ORSANCO at the time of sampling was more than 4 times higher on July 12 compared to July 7. The nearest gaging station that reports 15-min streamflow monitoring data is upstream of the Facility at Sardis, OH (Site #03114306). Streamflow at this gage around the time of this sampling was highly variable, ranging from 4,260 to 32,100 cfs on July 7 and from 11,600 to 27,500 cfs on July 12. Thus, even if the exact same mass of HFPO-DA were discharged from the facility outlets over the period of a few days, the concentration of HFPO-DA measured in the Ohio River would vary from dilution depending on the exact time of sampling.

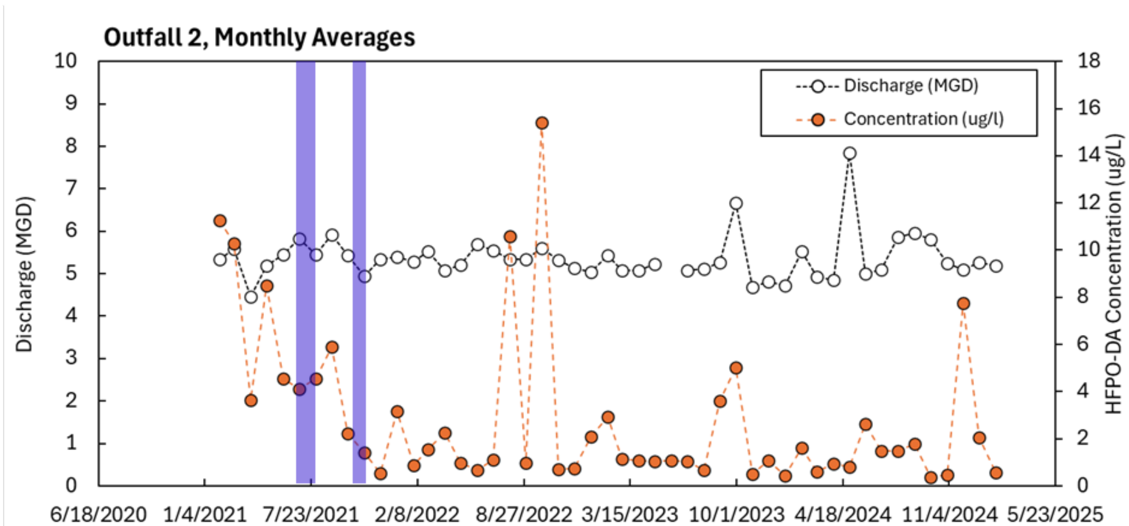
20. Ohio River flow not only impacts the dilution of HFPO-DA concentrations in the river, but also the downstream transport of HFPO-DA. I estimate the travel time for dissolved constituents in the Ohio River from the Washington Works facility in Parkersburg, West Virginia, to Louisville, Kentucky, a distance of approximately 400 river miles, may range from as low as ~4 days up to ~35 days.

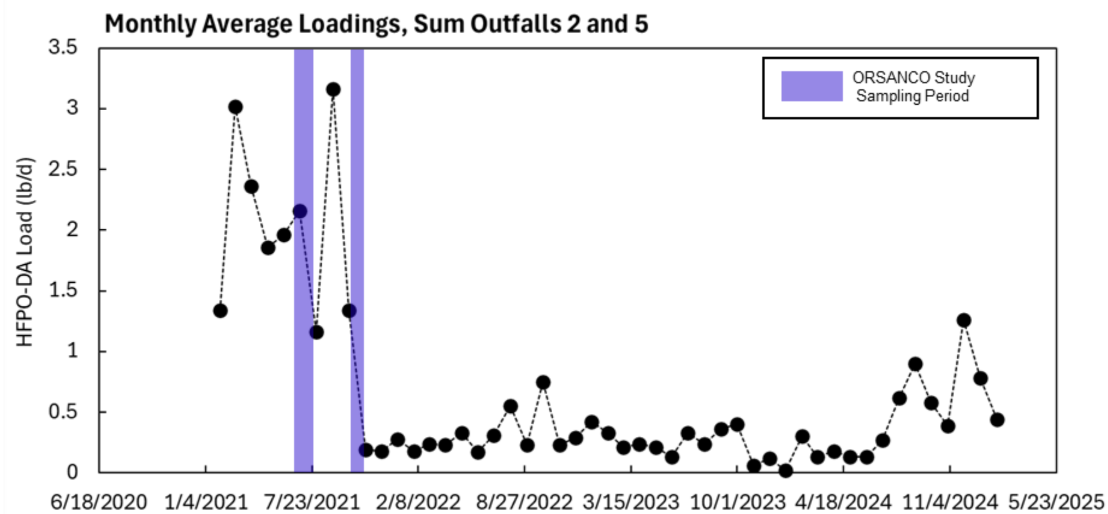
21. The ORSANCO sampling occurred over a period of approximately 4 weeks. Based on an approximated velocity for the Ohio River on the day of the ORSANCO sampling in Louisville, KY (June 28, 2021), I estimate the time for a molecule of HFPO-DA, based on non-

reactive transport, to travel the distance of 400 river miles from Parkersburg, WV, to Louisville to be roughly 10 days. Based on an approximated velocity for the Ohio River at Greenup, KY (located just upstream of RM 355) on the day of the ORSANCO sampling (July 6, 2021), I estimate the time for a molecule of HFPO-DA to travel the distance of 165 river miles from Parkersburg, WV, to Greenup to be roughly 8 days. Thus, HFPO-DA concentrations measured at different locations along the Ohio River during the ORSANCO sampling events represent concentrations that were transported through the river from upstream locations in the days prior to the sampling.

22. In the September/October ORSANCO sampling, concentrations of HFPO-DA in the Ohio River downstream of the Facility were generally lower than concentrations measured during the June/July sampling. This second sampling event by ORSANCO coincided with a decrease in average monthly concentrations and mass loading of HFPO-DA discharged from Outlets 002 and 005 to the Ohio River, per DMR reporting data. *See* graphs below.


Outfall 5, Monthly Averages
Discharge (MGD)
Concentration (ug/l)
Discharge (MGD)
HFPO-DA Concentration (ug/l)
6/18/2020 1/4/2021 7/23/2021 2/8/2022 8/27/2022 3/15/2023 10/1/2023 4/18/2024 11/4/2024 5/23/2025


Outfall 2, Monthly Averages
Discharge (MGD)
Concentration (ug/l)
Discharge (MGD)
HFPO-DA Concentration (ug/L)
6/18/2020 1/4/2021 7/23/2021 2/8/2022 8/27/2022 3/15/2023 10/1/2023 4/18/2024 11/4/2024 5/23/2025


Monthly Average Loadings, Sum Outfalls 2 and 5
ORSANCO Study Sampling Period
HFPO-DA Load (lb/d)
6/18/2020 1/4/2021 7/23/2021 2/8/2022 8/27/2022 3/15/2023 10/1/2023 4/18/2024 11/4/2024 5/23/2025

23. The graphs above also highlight recent increases in HFPO-DA concentrations. Beginning with the second ORSANCO sampling campaign in October 2021 to June 2024, monthly average concentrations of HFPO-DA ranged from 0.06 to 1.07 µg/L (or 60 to 1,070 ng/L). From July 2024 to January 2025, concentrations ranged from 1.36 to 2.93 µg/L HFPO-DA (or, 1,360 to 2,930 ng/L).

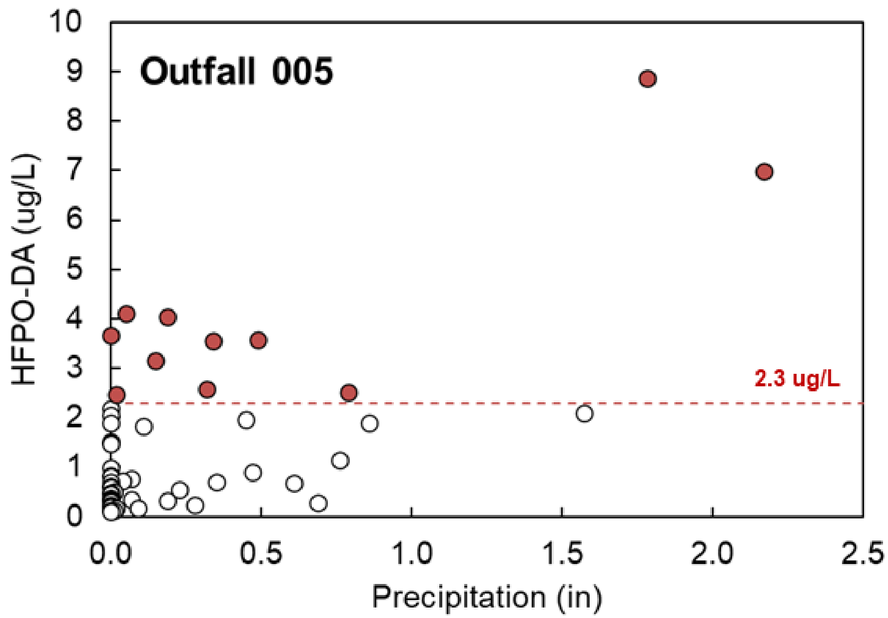
24. Over the course of the ORSANCO study, from June 2021 to October 2021, the sum of the monthly average load from Outlets 002 and 005 was variable, ranging from ~0.2 lb/d to ~3.2 lb/d, and the sum of daily maximum loadings for Outlets 002 and 005 ranged from ~0.3 lb/d to ~5 lb/d. During this same time, HFPO-DA concentrations were also reported for five samples collected from the Louisville water intake (*see* Declaration of Peter Goodmann). Using the reported concentration and daily average flows at stream gage #03294500 in Louisville, I estimated daily loads for these samples ranging from <0.3 lb/d to 4.9 lb/d.

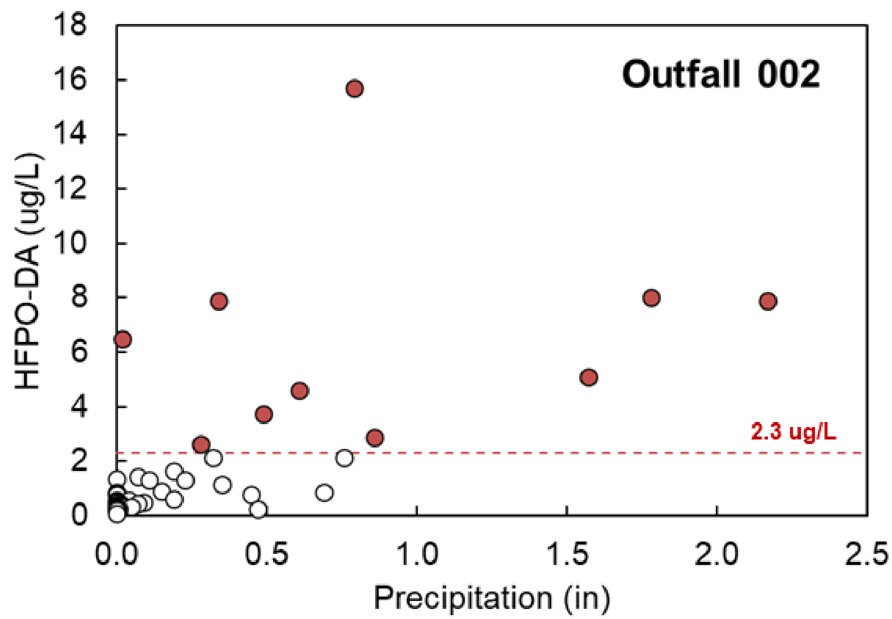
25. HFPO-DA can travel long distances in surface waters, such that the concentrations of HFPO-DA detected in Ohio River samples collected in Cincinnati and Louisville during the 2021 ORSANCO study likely included HFPO-DA discharged from Outlets 002 and 005.

26. Chemours collects weekly measurements from Outlets 002 and 005, but only monthly daily maximum and minimum values, and monthly averages for HFPO-DA concentrations and loads were available in the DMR reports I reviewed for the analysis above. The weekly outlet monitoring data would help evaluate the variability in mass loading of HFPO-DA to the Ohio River from outlets at the Washington Works Facility and its downstream transport.

27. Mr. Hartten presents a relationship between precipitation near the Washington Works property with HFPO-DA concentrations discharged from outlets 002 and 005 (paragraphs 40-45). Mr. Hartten states that "These results show that many exceedances of the HFPO-DA limits at Outlet 005 are correlated with precipitation events" (para 45) and draws a similar conclusion for Outlet 002 (para 43). This opinion overstates what the data reveal.

28. HFPO-DA concentrations in outlet discharges have been greater than 2.3 µg/L during times of little to no rainfall, in addition to high rainfall events. Below I include plots of precipitation versus HFPO-DA concentrations for Outlet 002 and 005 based on the same datasets compiled by Mr. Hartten to illustrate the weak correlation between precipitation and concentration. The graphs indicate that for Outlet 005, for example, 9 of the 11 measurements of HFPO-DA greater than 2.3 µg/L occurred on days when rainfall was less than 0.8 inches.





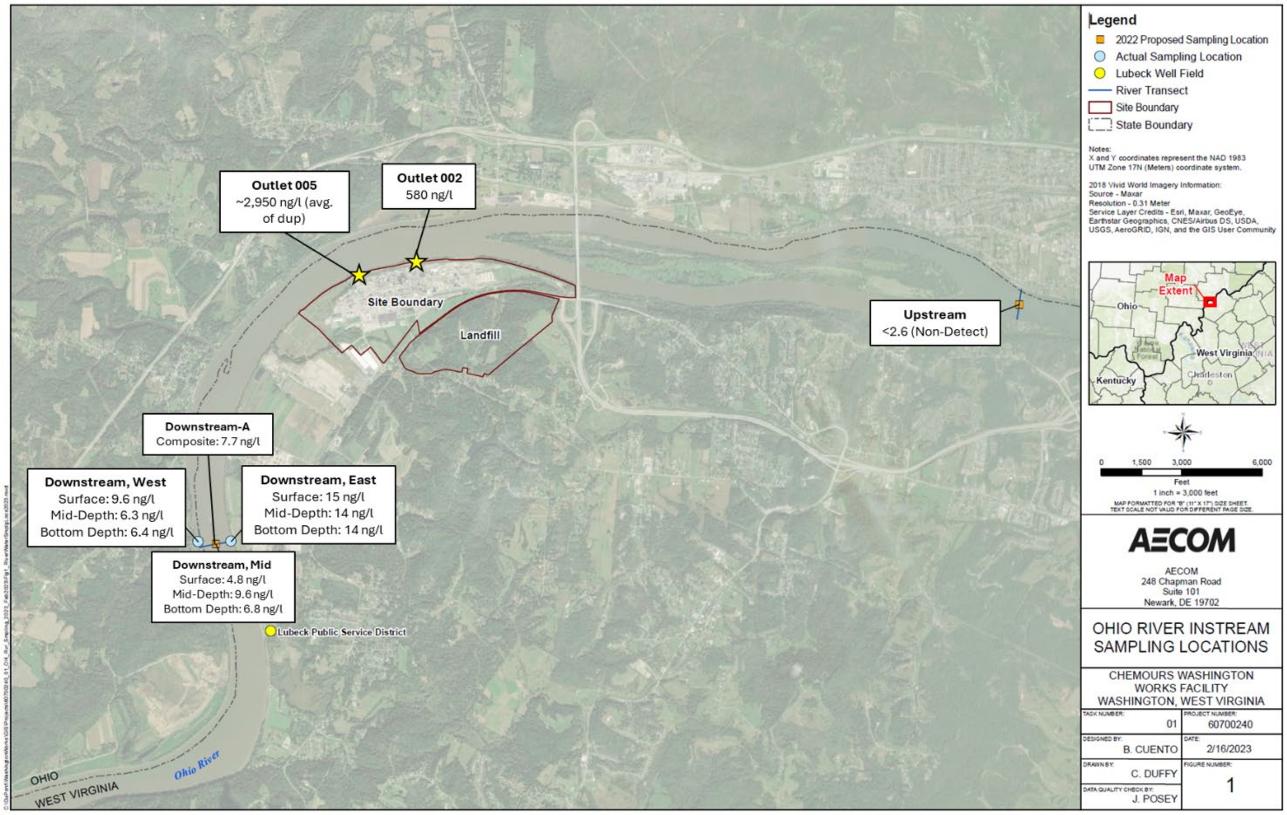
29. From these precipitation data, I conclude that concentrations above 2.3 µg/L occur in dry weather as well as during precipitation events.

30. Ms. Boston presents an analysis of HFPO-DA concentrations reported in Attachment 25i of NPDES permit application #WV0001279 for samples collected in the Ohio River at an instream monitoring location 1.75 miles downstream of the Washington Works

facility and 0.5 miles upstream of the City of Lubeck well field. Ms. Boston states, “The calculated annual average for the downstream location in the Ohio River was 1.9 ng/L, which is below the 10 ng/L MCL for drinking water” (paragraph 21). The dataset Ms. Boston relies upon for this calculation includes results for 10 depth-composited samples collected from the middle of the Ohio River channel.

31. On four of the ten sampling dates referenced by Ms. Boston, Chemours also collected samples from the eastern and western sides of the Ohio River. Samples were collected at three depths – surface, middle, bottom– at these locations.

32. The cross-sectional data for three of these four sampling dates (9/28/22, 11/2/2002, and 12/12/2022) were available in Attachment 19 to Chemours’ 2023 reissuance application for its NPDES permit (attached as Exhibit 26 to Plaintiff’s motion for preliminary injunction). Of these three sampling dates, the concentrations of HFPO-DA in outlet 005 were highest on 9/28/2022. On this same date, HFPO-DA concentrations on the east side of the river, the same side as the facility outlet discharge locations and the Lubeck Well Field, were 15 ng/L at the surface depth, and 14 ng/L at the middle and bottom depths. On 11/2/2022, the only detection of HFPO-DA was the surface location on the eastern side of the river. The map below is from Attachment 19, modified to include the HFPO-DA concentrations measured on 9/28/2022 and the outlet 002 and 005 locations.



31. Ms. Boston's calculation of an annual average HFPO-DA concentration of 1.9 ng/L for the downstream monitoring location is misleading because it is only based on the concentration data from the mid-channel samples. The sampling event from 9/28/22 is an example of cross-sectional variability in HFPO-DA concentrations at this downstream monitoring location, which suggests there are times when discharges of HFPO-DA from site outlets may not be fully mixed across the channel at this location.

All of my opinions in this matter are within a reasonable degree of scientific certainty. I declare under penalty of perjury that the foregoing is true and correct. Executed on March 18, 2025.

Beth Hoagland Digitally signed by Beth Hoagland Date: 2025.03.18 21:09:45 -04'00'

Beth Hoagland, Ph.D.

S.S. Papadopulos & Associates, Inc.
Environmental & Water Resource Consultants

Beth Hoagland, Ph.D.

Project Scientist, Geochemist

Dr. Hoagland's expertise covers contaminant fate and transport, geochemical modeling, groundwater/surface water interactions, and human impacts on water resources. She has experience providing litigation support and testimony, leading field investigations, evaluating chemical fingerprints, and assessing environmental issues both domestically and internationally. She has applied skills in geochemical modeling, managed aquifer recharge, environmental sampling, data processing and visualization, and analytical chemistry. Her experience includes providing community-embedded science services leading trainings and workshops for marginalized communities to address a wide range of water-resource challenges. She provides expertise for projects to address inorganic contaminants and PFAS, particularly in watersheds impacted by mining, agriculture and industry. Dr. Hoagland contributes to numerous expert and site reports that integrate hydrogeochemical data across multiple environmental media.

REPRESENTATIVE EXPERIENCE

S.S. Papadopulos & Associates, Inc. *– Rockville, Maryland*

PER- AND POLYFLUORINATED ALKYL SUBSTANCES (PFAS)

PFAS Fate and Transport from Land Applied Biosolids, Confidential Client: For an ongoing project, compiled, reviewed, and mapped PFAS analytical for surface water, groundwater, landfill leachate, and fish tissue. Used chemical fingerprinting analysis to assess the origin of PFAS in groundwater relied upon by private well owners.

PFAS Sites, Confidential State Agency: For several sites impacted by per- and polyfluoroalkyl substances (PFAS), assessed the extent of PFAS contamination and evaluated existing data and proposals for remedial actions. The evaluation involved reviewing historical site documents regarding manufacturing processes, disposal practices, site investigations, and remedial measures previously implemented. For each site, data gaps and areas requiring additional investigation were identified and the impacts of past disposal practices and previous remedial measures were evaluated. Identified potential receptors, including private wells and public water systems. Prepared cost estimates for the addition of PFAS treatment to residential and public drinking water systems. In addition, the work included evaluating existing proposals for remediation of soils and water for PFAS, chemical fingerprinting, geospatial analyses of chemical data, and calculations of impacted water volumes.

PFAS Fate & Transport, Private Client (plaintiffs), Alabama: Contributed to a detailed evaluation of the chemical composition of per- and poly-fluoroalkyl substances (PFAS) at a wastewater treatment land application site. Evaluated the fate and transport of PFAS downstream from the source to drinking water intakes and reviewed three decades of chemical sales and purchase records of PFAS to constrain quantities of disposed PFAS waste. Also assessed PFAS remediation options and costs. This work was conducted to support expert opinions on the matter.

PFAS Fate and Transport from Biosolids, Southern Environmental Law Center, Georgia: evaluated the presence, fate, and transport of per- and polyfluoroalkyl substances (PFAS) originating from effluent discharges and land application sites in Calhoun, Georgia. Performed GIS analysis of biosolid field locations and sizes, compiled and reviewed biosolids application rates, and calculated a water balance to estimate the potential for groundwater discharge of PFAS to rivers.

YEARS OF EXPERIENCE

5+

EDUCATION

- **PhD**, Geosciences and Biogeochemistry, The Pennsylvania State University, 2018
- **BA**, (*magna cum laude*) Environmental Earth Sciences, Washington University, St. Louis, 2014

EXAMPLE AREAS OF EXPERTISE

- Contaminant Fate and Transport
- Groundwater/Surface Water Interactions
- Geochemical Modeling of Inorganic Contaminants and PFAS
- Managed Aquifer Recharge (MAR)
- Hydrogeology

AWARDS AND HONORS

- National Science Foundation, Earth Sciences Postdoctoral Fellowship (EAR-PF), "*Source or Sink? Hyporheic zone controls on the biogeochemical processing of arsenic in rivers impacted by acid mine drainage*": 2019–2020
- National Science Foundation, Graduate Research Fellowship: 2014–2018
- National Science Foundation, Graduate Research Opportunities Worldwide (GROW), "*Industrial and climate-induced trace metal mobilization and transport in Porgera, Papua New Guinea*": 2016
- Geological Society of America, Graduate Research Grant: 2016

APPOINTMENTS AND COMMITTEES

- 2022 – 2023: ITRC Managed Aquifer Recharge Technical Committee
- 2020 – 2024: Reviewer for Frontiers in Water

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Work resulted in a consent decree requiring updated wastewater treatment infrastructure, private well testing and treatment options, and cessation of land application of biosolids to inhibit PFAS discharges to surface waters.

PFAS Contamination of Private Wells, Multiple Private Clients (plaintiffs): Class action and private lawsuits regarding PFAS contamination of residential drinking water wells from an industrial source, including field sampling for PFAS analysis, database construction and spatial analysis of PFAS data, public engagement, evaluation of PFAS transport pathways, and contributions to an expert report.

Multi-State Evaluation of PCB Releases to Environmental Media, Confidential Client: researched the origin, transport pathway, and fate of polychlorinated biphenyls (PCBs) to sediments and surface waters across multiple states. Analyzed sales records and identified facilities that received and discharged PCBs to the environment. Compiled and evaluated congener data to assess the timing of PCB releases to the environment.

Lead Contamination Incident, Confidential Client, Maryland: Developed work plans and collected paint chip and soil samples, evaluated lead chemical data, and researched air dispersal of lead-based paint chips to determine links between a hydroblasting operation and impacted residential properties as part of a class action lawsuit.

Interstate Technology and Regulatory Council (ITRC), Managed Aquifer Recharge Team: Led the literature review, writing, synopsis, and publication of the "Water Quality Considerations" and "Geochemical Compatibility" sections of the ITRC Guidance Document on Managed Aquifer Recharge.

METALS AND MINING

Gold King Mine Spill, Colorado: Evaluated the fate and transport of trace metals in the San Juan River watershed following an accidental mine release. Served as an expert witness on behalf of the plaintiffs - the State of New Mexico, Navajo Nation, and regional farmers.

Geochemical Modeling for the Porgera Gold Mine, Papua New Guinea: Collected water and sediment samples, conducted laboratory batch experiments, and conducted geochemical modeling in PHREEQ-C to evaluate the attenuation and release of arsenic from mine tailings treated with lime. Model output and interpretation published in peer-reviewed journal.

Fate and Transport of Metals from Acid Mine Drainage, Silverton, Colorado: led research evaluating the role of groundwater-surface water interactions and microbial processes on the fate and transport of metals such as lead, arsenic, aluminum, and zinc from streams receiving acid mine drainage. Used multidisciplinary methods such as field tracer experiments and 1D transport modeling, chemical analysis of sediment and water data, and 16S rRNA gene sequencing for microbial analysis. Research resulted in three peer-reviewed publications.

Former Tin Smelting Facility, Texas: Analysis of radium attenuation in groundwater, including evaluation of data quality, ratio analysis, GIS analysis, and geochemical modeling.

MANAGED AQUIFER RECHARGE

Managed Aquifer Recharge (MAR), Merced, California: Modeled the geochemical compatibility of surface water and native groundwater for a agricultural aquifer storage and recovery (Ag-ASR) well with an intended use

Continued from previous page

- 2018 – 2021: Reviewer for Water Resources Research
- 2019: Reviewer for International Journal of Environmental Research and Public Health
- 2018 – 2019: Reviewer for Science of the Total Environment
- 2017: Reviewer for Hydrological Processes

PROFESSIONAL SOCIETIES

- American Society for Microbiology (ASM)
- The Geochemical Society (GS)
- American Geophysical Union (AGU)
- National Groundwater Association (NGWA)
- Interstate Technology and Regulatory Council (ITRC)
  - Managed Aquifer Recharge (MAR) Subgroup: 2022–2023

PROFESSIONAL HISTORY

- S.S. Papadopulos & Associates, Inc.: 2021–present
- Colorado School of Mines, Department of Geology and Geological Engineering, NSF Earth Sciences Postdoctoral Research Fellow: 2019–2020
- The Pennsylvania State University, Department of Geosciences, NSF Graduate Research Fellow: 2014–2018
- United States Geological Survey, Hydrology Student Trainee: 2013–2014
- Washington University in St. Louis, Stable Isotope Biochemistry Lab, Research Assistant: August 2013–May 2014
- American Geoscience Institute, Science Policy Intern: May–August 2012

EMAIL

bhoagland@sspa.com

for irrigation purposes. Modeled and reviewed literature to evaluate the source and mechanisms of uranium release in recovered groundwater. Results delivered to client as a technical memo.

Managed Aquifer Recharge (MAR), City of Santa Cruz, California: Modeled the geochemical compatibility of surface water and native groundwater for an Aquifer Storage and Recovery (ASR) well used for drinking water supply. Modeled and reviewed literature to evaluate the source and potential mechanisms of mercury release observed in recovered water.

Aquifer Recharge Evaluation, Central Valley, California (Confidential): Led a geochemical evaluation and geochemical fingerprinting analysis to evaluate sources of recharge, basin-wide groundwater chemistry, and groundwater ages for the purposes of allocating irrigation water supplies for a water district. Analysis included data compilation and management from the CA Groundwater Ambient Monitoring and Assessment database, GIS analysis of water quality data, and geochemical calculations, and review of the hydrostratigraphy for the groundwater basin.

Aquifer Recharge and Geochemical Evaluation, Santa Clarita, California: Evaluated inorganic and isotope data collected from depth-discrete intervals of a pilot water supply borehole. Project objectives were to review lab reports and evaluate water quality, analyze changes in groundwater chemistry with depth, evaluate sources and mechanisms of groundwater recharge at the production well location, and estimate groundwater ages. Reviewed local geology, hydrogeology, and supplemental geochemical data. Results delivered to client as a technical memo.

Managed Aquifer Recharge (MAR), City of Hermiston, Oregon: Supported modeling efforts to evaluate the geochemical compatibility of treated surface water and native groundwater for an Aquifer Storage and Recovery (ASR) well used for drinking water supply and thermal conditioning of the aquifer for industrial water use. Contributed to research on the hydrochemistry of the receiving aquifer.

OTHER

Allocation, Confidential Client (defendants), California: Multi-party allocation of contributions to groundwater contamination for a variety of organic/inorganic constituents, including evaluating fate-and-transport in proximity to public supply wells.

Groundwater Resource Evaluation, Confidential Country: Led the geochemical analysis and development of a conceptual geochemical model including an evaluation of water quality, flow paths, groundwater age, and sources of recharge for a country-wide water resource evaluation

Closure of Coal Ash Ponds, Confidential Client (plaintiffs), Kentucky and Indiana: Evaluated leachate chemistry and groundwater flow paths from coal ash ponds.

Paper Mill Impacts, Private Client (plaintiffs), South Carolina: Class action lawsuit regarding the impacts to groundwater from a paper mill, including analysis of dioxins and inorganic contaminants in groundwater, surface water, and sludges.

*Publications & Presentations (*peer reviewed journal)*

*Carey, G.R., Danko, A., Pham, A.L.-T., Soderberg, K., Hoagland, B. and Sleep, B., 2024. *Modeling the Influence of Coastal Site Characteristics on PFAS in Situ Remediation*. Groundwater. doi: 10.1111/gwat.13456

Andrews, C.B., DiFilippo, E., Hoagland, B., and Davis, G. (in prep). *Land Application of polymer based Per- and Polyfluoroalkyl Substances (PFAS) as long-term source to surface water in the Alabama River System*.

ITRC. 2023. *Water Quality Considerations*, Managed Aquifer Recharge Guidance Document, s. 3.5, December 2023.

*Hoagland, B., K. Rasmussen, K. Singha, J. Spear and A. Sitchler, 2024. *Metal-Oxide Precipitation Influences Microbiome Structure in Hyporheic Zones Receiving Acid Rock Drainage*. Applied and Environmental Microbiology. doi: 10.1128/aem.01987-23

*Singley, J., M. Briggs, B. Hoagland, R. Lauer, J. Meeks, A. Regberg, D. Rey, K. Swift-Bird, and A. Ward, 2023. *Integrated Field, Model, and Theoretical Advances Inform a Predictive Understanding of Transport and Transformation in the Critical Zone*. Journal of Hydrology. doi: 10.31223/X5G930

*Hoagland, B., A. Navarre-Sitchler, K. Singha, K. Rasmussen, and J. Spear, 2022. *Microbiome Structure Influenced by Metal-Oxide Precipitation in Hyporheic Zones Receiving Acid Mine Drainage*. Goldschmidt Conference. doi: 10.46427/gold2022.10190

Happel, E., B. Hoagland, O. Jean-Pierre, T. Russo, and M. Satterthwaite, 2022. *Community-Owned Baseline Water Data: Science and Human Rights for Community Power Building*. AAAS-Science and Human Rights Coalition, Webinar Series, June 8, 2022.

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Deposition & Testimony Experience

DEPOSITIONS

- 2022 – Gold King Mine Release in the San Juan County, Colorado, on August 5, 2015. United States District Court for the District of New Mexico. Case 1:18-md-02824-WJ. January 10.